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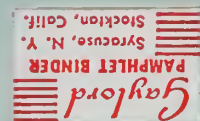
A MEDIA ALLOCATION MODEL FOR
PSYCHOLOGICAL OPERATIONS

by

John Dennis Lanigan

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THESIS

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PSYCHOLOGICAL OPERATIONS

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John Dennis Lanigan

June 1968

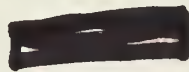
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A MEDIA ALLOCATION MODEL FOR PSYCHOLOGICAL OPERATIONS

by

John Dennis Lanigan
Major, United States Marine Corps
B.S., Naval Academy, 1958



Submitted in partial fulfillment of the
requirements for the degree of
MASTER OF SCIENCE IN OPERATIONS RESEARCH

from the

NAVAL POSTGRADUATE SCHOOL
June 1968

NPS ARCHIVE TWO
1968
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ABSTRACT

This thesis demonstrates the formulation and use of a "goal programming" model in optimizing the allocation of media for psychological operations. The parallels between advertising and psychological operations are outlined; particularly, those in connection with defining a product, specifying a target audience and measuring success. Attributes and limitations of the various forms of mass media are discussed. The problem is developed as one of minimizing the variance between a set of goals stated with respect to specified target audiences for varying time frames subject to budget and resource limitations. The goals considered are related to the total number of times that members of a target audience are subjected to propaganda, the percent subjected and frequency of subjection. Ultimately, a numerical example is presented to demonstrate the potential use of the model.

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ACKNOWLEDGEMENT

The assistance rendered by Mr. E. F. Snow of Batten, Barton, Durstine and Osborn, Inc., and Dr. D.B. Learner of Applied Devices Corporation, was invaluable in the preparation of this thesis and is herewith gratefully acknowledged.

CHAPTER I

INTRODUCTION

The use of propaganda techniques, whereby one party seeks to change or mold the behavioral and mental processes of another party, can be found throughout history. Indeed, the Bible cites many examples whereby these techniques are used to cause the people to fear the wrath of God. The books of the Prophets contain many examples of "propaganda"; e.g., the people are told that if they do not deny false gods, repent, and reform, they will suffer the eternal damnation of almighty God. However, in modern days, the term "propaganda" has been primarily reserved for usage in reference to war-connected or political activities; whereas, a country's internal use of propaganda is referred to as "advertising" or "marketing strategy". Karin Dovring, author of Road of Propaganda, has coined another term for propaganda. She writes:

"...Biased communication is a sophisticated term for propaganda, a word feared or avoided by all objective people and therefore a source of darkness and obscurity since nobody wants to talk about it but nevertheless everybody uses it."¹²

Advertising, biased communication and propaganda all seek to change behavior and herein lies the purpose for which this thesis is written. The commercial use of advertising has become much more sophisticated than that of its military counterpart. Many years have been expended in marketing research to determine the best methods of presenting information to a target audience so that they will buy a

certain product, vote for a given politician or change their beliefs. It is felt that this knowledge has not been satisfactorily applied to military problems. If there are techniques available that can create "needs" for items such as electric tooth brushes, pens that write under water or aftershave lotions that will make every man a Valentino; then, it seems reasonable that these same techniques could be used to "win the hearts and minds" of the populace in a given country or to cause an enemy force to fight less effectively or to surrender.

Historical Background of Modern Psychological Operations

The emergence of psychological operations as a rudimentary science is considered to be the First World War. In England, a Department for Enemy Propaganda (known as Crewe House) was established to co-ordinate the allied propaganda efforts. Representatives from France, the United States, and Italy worked with the British in unifying all propaganda efforts during the war. The efforts of Crewe House were lauded by the Germans subsequent to the war. However, this credit was largely undeserved; the Germans found it far more palatable to admit loss of the war due to propaganda efforts than they did to admitting that their armies had been severely defeated on the field of battle.¹⁵

The major lessons in psychological warfare (a term used almost interchangeably with psychological operations)

that evolved from the First World War are summarized as follows:

1. In many cases it is best for the propagandist to use self restraint in his efforts. The overstated case may well alienate a potential sympathizer.

2. Stereotyped and unimaginative propaganda, such as the German claims of allied atrocities, is worse than no propaganda at all.

3. Uncommitted nations are generally adversely impressed by any appeals for their sympathy or pity.

4. Denials of enemy propaganda are often dangerous. The old adage, "He who excuses himself accuses himself," proved to be true in a number of instances.¹⁵

The propaganda principles that were applied by Hitler and the German National Socialist party in their rise to power are in many ways at odds with what has come to be accepted as the "proper" means of establishing an effective psychological operations campaign. National Socialist propaganda was lacking in either internal or external consistency. At times it was hysterical and emotionally uncontrolled while at others it appeared to be the product of a cold and calculating intellect. However, its success cannot be denied. Hitler based his propaganda campaign to the German people on their desire for national self respect and personal self assurance, their self pity and fear, a belief that if Germany were given a chance she could surpass all other nations, and a claim that his party was one aimed at

the betterment of the "little man". Basically, Hitler's propaganda principles can be summarized as follows:¹⁸

1. Appeals to the emotions of a people are much more important than appeals to their reason. (Hitler believed in assertion and not in argument.)

2. The passions of a target audience must be directed at one clearly-defined enemy or they will become weakened by dispersal. (In the case of Germany this enemy was, of course, the Jews.)

3. All means whereby the populace receives information should be controlled. Strict censorship must be enforced.

4. Consistency is not important. (Hitler changed his propaganda messages to suit the mood and makeup of different target audiences.

By following these principles Hitler achieved unqualified success within Germany. However, his attempts to affect other nations in this way failed.

During World War II the allied forces considered propaganda to have a three-fold purpose: to impress and to depress one's enemies; to comfort, encourage and advise friends; and to divide one's enemies against one another. Further, propaganda was always to be truthful, consistent, and frank. (Later in the war it became apparent that being truthful was not sufficient; propaganda had to be believable.) In the long run, the psychological operations conducted by the allied powers proved to be more effective than any of those conducted by the axis powers.¹⁵

The relative austerity of the United States' propaganda efforts during the first two wars is succinctly stated by Doctor Hans Speir of Princeton University.

"In the two world wars American psychological warfare was improvised after the outbreak of hostilities and conducted according to hit-or-miss methods. No peace-time agency existed which had preserved and developed pertinent skills and knowledge in this field, trained expert personnel, or engaged in appropriate research and planning. Psychological warfare was regarded as an operation requiring no planning, training, and research."²³

Today, we are somewhat better off in our preparations for psychological operations but the field is still open to vast improvement. The American people do not like to believe that there is any need for "propaganda" and the term itself has come to connote a bad or evil practice. It is hard to imagine a "propaganda ministry" being established as a part of our national government. However, there is very definitely a need for some institution that would effectively serve this purpose. Agencies such as USIA are doing part of this job, but more needs to be done to cope with the many global conflicts that confront us today. We cannot rest on our laurels and expect the rest of the world to admire and support us because we are so all powerful or because the standard of living in our "great society" is so much above that of most of the rest of the world. Our country must strive to be more successful in combatting Communism than we have been in the years since the end of the Second World War. The instruments of global policy; propaganda, diplomacy, economics, and war must be judiciously

applied. Otherwise, many of the now emerging nations will become communist oriented.

Effective Propaganda

To be effective, propaganda must fill four essential conditions.¹²

1. It must gain and hold the attention of those people whom you specifically desire to receive your message; that is, your target audience.

2. It must be believable to both the members of the target audience and to others with whom they may discuss it.

3. It must be directed so as to lead the target audience along a path they are "willing" to follow.

4. It must be propagated in an environment that will allow the target audience to pursue the course of action desired.

This Thesis

Thus far we have discussed many of the reasons that make psychological operations important and have summarized some of the propaganda principles that have evolved since the First World War. This was done to stress the need for careful planning in preparing for psychological operations.

Once this planning has been accomplished and the propaganda themes have been established we must then decide on best ways to propagate our messages to specific target audiences. This is the problem area that is addressed by this thesis. Specifically, we shall develop analogies

between message dissemination in advertising and in psychological operations. Then, we shall show how a goal programming model that is currently being used to project "optimal" media allocation for advertising U. S. consumer goods can be successfully applied to use in psychological operations.

In the following chapters, we shall first discuss the meaning of the term "product" as it would be applied to psychological operations. Then, we will consider the audience itself; that is, its stratification, receptivity and access to various forms of communication media. Next, the problems of measuring the success of various psychological campaigns will be discussed in rather broad terms. This is not done to negate the importance of feedback. In fact, without some effectiveness measurement there would be no way to evaluate the predictive success of the media mix model that will be used. However, the problems inherent to evaluating success are in themselves still very much in the research stage.

Prior to presenting the media mix model, we shall discuss the basic communication process and some of the means of transmitting information. This is done so that the reader can better understand why considerations other than cost or number of people to be communicated with may be important. Some media vehicles (where "media vehicle" is defined to be the medium that brings a message to the attention of a target audience)²⁶ have greater prestige,

more impact, etc., than others. For instance, in the United States, a number of companies specify that "regardless of the cost" they want at least one advertisement to appear in Life magazine. Here, there is a definite prestige factor in that the company can then use the phrase, "as advertised in Life" in other advertisements.

Finally, we shall present an example of how the model can be used, state conclusions and make recommendations for further study in this area.

CHAPTER II

COMPARISON AND CONTRAST OF ADVERTISING TO PSYCHOLOGICAL OPERATIONS

In this chapter we shall discuss some of the major similarities and differences between advertising and psychological operations. In this way, we will be able to develop analogies that can be used in connection with the media mix model that will be presented in a later chapter.

Initially, a general overview concerning the applicability of advertising techniques in psychological operations will be given. Then, we shall consider the major factors that must be accounted for in both advertising and psychological operations. These are: the definition of the product; the target audience; and, the measures of success.

Obviously, there is not a one-to-one mapping of the parameters involved in advertising to those necessary for psychological operations. However, this has sometimes been taken to be the case. Writing about the United States' psychological warfare policy during the Second World War, Donald V. McGranahan refers to an "'advertising complex' that underlay our conception of propaganda." He goes on to state,

"Our ideas of successful propaganda in this country are derived to a large extent from the principles of advertising and public relations, and our policy makers, unconsciously perhaps, seem to have applied the same principles to psychological warfare."²³

Further on in his article, Mr. McGranahan does an excellent job in summarizing the advertising philosophies in order to compare them to their psychological operations counterparts.

"In advertising, you are careful not to offend the public or any important segment of it. Your interest is in the broadest mass audience and the lowest common denominator. You do not attack established values and symbols. You avoid debate and debatable issues, and make your appeals to attitudes that are widespread and noncontroversial--desire for physical comfort, health, beauty, popularity, love of home and children, etc. If the advertiser wants to introduce a social change, such as getting women to smoke cigarettes, he does so by indirect methods, never openly attacking the belief or custom that is the main obstacle to his efforts. When the advertising philosophy of propaganda is carried over into the field of national psychological warfare, it results quite naturally in the theory that we should avoid open discussion of political faith and loyalties, where opposing passions may be aroused, and concentrate on non-ideological uniformity among the enemy population."²³

This "advertising approach" to psychological operations may be applicable in many situations. However, we must be certain that we do not mask possible psychological victories by completely stereotyping our propaganda techniques and policies to those that have proven to be successful on Madison Avenue. No one can doubt the success of religious propaganda, whereby Christianity has been spread throughout the world; yet, missionaries have readily damned pagan beliefs, condemned non-converts to the everlasting fires of hell, and forthrightly stated that conversion was their ultimate goal. These are certainly not accepted advertising

techniques but they have worked and are still working today in some parts of the world.

Another type of propaganda, revolutionary propaganda, has also been very successfully used; particularly so by the communists in the past twenty years. Generally, the proponents of revolutionary propaganda are careful not to attack the people themselves but attack existing political systems and the leaders that are enforcing them. Here again, this approach is somewhat at odds with both the advertising and religious approaches.

The point to be made is that psychological operations should be specifically tailored to the problem at hand and not necessarily patterned on any one method or technique nor on any combination of them. There may be occasions when some of the techniques used by the missionaries can be effective; particularly, when we are dealing with superstitious or very "backward" people. On other occasions it may be our desire to foment revolution; e.g., in Cuba today. However, the techniques and policies that are applicable to one situation may be totally inappropriate in another. We cannot devise a "standard operating procedure" for psychological operations as a whole. Any stereotyped plans or methods of operation will almost surely detract from the overall success of our propaganda efforts.

We have agreed that the administration of the U. S. psychological operations should not necessarily be relegated to the advertising giants of Madison Avenue. The

techniques that they have developed will certainly be a help, as will some of the ones that have been used by missionaries and revolutionaries. Although, psychological operations is an entity unto its own and is not meant to be defined as a function or subset of any other form of mass communication, there do exist some analogies. We shall now discuss those that will be important in the model to be presented in this paper.

The Definition of the Product

One of the major differences between advertising and psychological operations is that in psychological operations there is no clearly defined product. One can see, feel, or taste a newly marketed brand of toothpaste; however, such "products" as allegiance, loyalty, or willingness to bear arms in defense of one's country defy animate description. One cannot drink a pint of allegiance or squeeze a tube of loyalty. However, there are some ways in which the nebulous concerns of a governmental power can be defined so that they might be treated as products.

We might proclaim a governmental chief in a manner similar to that which is used in the campaigns of many of the politicians in this country today; that is, sell the man and we will sell the ideology he represents. This method of defining the product may be a good one if we have a leader with whom the people desire to identify. The defeat of the Huks in the Phillipines was largely facilitated by the charismatic leadership of Ramon Magsaysay. On the other hand, selling the man may have serious limitations. One wrong action

on the part of the leader being exalted, his demise at the expense of some insurgent power or even his death may greatly diminish the effectiveness of a propaganda campaign.

A second way to define the product is essentially the converse of the first. That is, we publicize a public office as the embodiment of a certain ideology. (In Thailand, the King might well be the "product".) In this way, we allow for the contingencies that may befall the man currently holding office. (If the present king should die a new king would take his place.) This means of defining the product does not have the inherent drawbacks of the first method. However, the product may be weaker in the sense that many of the people will not personally attach themselves to an office in the same manner in which they would a man.

Nationalism, national unity, and heritage can all be loosely defined as "products" in certain situations. Naturally, these products would not be of much benefit in Russia or Communist China. They would also be of limited benefit in divided countries like Vietnam or Korea since national unity is one of the terms that the communists use in their attempts to instigate revolution. However, in a country like Thailand, where there exists a comparatively contiguous population and relatively strong central ties, a product such as national unity may be salable.

One "product" that can be used in virtually any environment is that of freedom. It could be defined differently for each target area of our concern. In Russia we might define it as freedom of choice, freedom to speak and write as one

desires, etc.; whereas, in the underdeveloped countries we would define it in terms such as freedom from hunger or freedom from disease. The major consideration in using "freedom" as a product is that of making it believable. Advertising that a doctor will be placed in every village may be as unbelievable to a Vietnamese peasant as would be a presidential candidate in the United States promising a Cadillac for every man over eighteen.

Hate, if properly directed can also be a very effective product. It was most certainly used in this country during the Second World War to foster an American antagonism against the Germans and Japanese. Hitler used it in his rise to power, by attempting to focus the hatred of the German people on the Jewish race. Today, hate is one of the major propaganda products being used by the many militant groups that have formed in the United States. We may ask ourselves the question; How much sooner would the war in Vietnam end if we were able to instill in the U.S. and South Vietnamese peoples a true hatred for the Viet Cong?

Thus far, we have not considered the "products" or "counter-products" that are being "sold" by the enemy. We can be certain that he will do all in his power to publicize every governmental shortcoming (whether real or imagined), mistake, or action that can in any way be construed as one that will be displeasing to the populace. If a leader is proclaimed as the embodiment of certain ideals, the enemy will try to counter by magnifying any defects in

his character or mode of operation. Normally, it will not be to the best interests of the government to discredit enemy propaganda by public denials. It is often better to simply ignore it than it is to re-publicize it in an attempt to explain, qualify or deny enemy accusations.

The enemy may also use assassination or other terrorist techniques as propaganda tools. If the government of a country is fortunate enough to have a particularly strong leader it may be to the advantage of the enemy to assassinate him. The initial hatred that is provoked may be counterbalanced by the loss of leadership to the country. Further, a feeling of fear and insecurity will often permeate a country where there is widespread use of terrorist tactics. The central government may be hardpressed to counter insurgent psychological operations of this nature. Generally, it is not sufficient for the government to claim that better protection for the people is on the way. When people are being bombed or burned out of their homes they want immediate protection, not promises.

We have by no means exhausted the list of possible propaganda products but have merely selected some of the more important ones. In waging any psychological war there will generally be a number of propaganda themes that can be sufficiently well-defined to allow their use as products in the model presented in this paper.

The Target Audience

Marketing organizations within the United States are dealing with a comparatively homogeneous audience; whereas, psychological operations will often be conducted against highly diverse populations. The variation in the effect of a promotion slogan used in Southern Florida and Northern Washington State (over 3500 miles apart) may be negligible in comparison with the expected variance between two Vietnamese villages only a few miles apart. (The converse might also be true if we were considering the difference between Brooklyn, New York, and Jackson, Mississippi.) It is for this reason that we must be particularly careful in defining the various segments of a target audience to insure that the demographic, social, and economic groupings we have selected are the ones that are most applicable to the situation. We must consider the mores, beliefs, taboos, sensitivities, education, allegiances and leadership of all ethnic, religious, cultural or any other groupings that may exist within the target country.

One U. S. advertising firm subdivides the U. S. population into a number of demographic groupings, many of which overlap. It is then possible for them to select primary and secondary target audiences for each advertising venture. This type of subdivision of target audiences will be even more important in psychological operations in that there is normally a greater diversity in the population. The following are included in their breakdown of the U. S. population:

1. Total population (children, teens, adults).
2. Teens by sex.
3. Age (18-24, 25-34, 35-49, 50-64, over 65).
4. Occupation (Prof. & Tech., Unskilled, Farm, etc.).
5. Income (under \$3000.00, \$3000.00-\$5000.00, etc.).
6. Size of county (less than 5000 people, 5000 - 10,000 people, etc.).
7. Region (New England, Metropolitan New York, Middle Atlantic, etc.).
8. Size of family.

Each of the above categories is defined for men, women, and "ladies of the house" who are treated as a separate entity since they are quite often the prime audience for advertising campaigns. It should also be noted that the number of people in each of categories (4) through (7) are the same.

For psychological operations we can transform this breakdown into a useable form by establishing different sub-categories: e.g., the salary breakdown in category (5) would be almost meaningless in most of the underdeveloped countries since the greatest plurality of the people would be in the "under \$3000.00" category; there would be no need for the separate classification "ladies of the house"; etc. Further, we would need to add other categories to the list to represent special considerations indigenous to the target country such as:

1. Religion (Catholic, Buddhist, etc.).
2. Race (Vietnamese, Chinese, etc.).
3. Political loyalties.

When we appeal to a target audience we are eliciting their support for some ideology. We may be asking for their active support, in the form of intelligence or paramilitary help, or merely soliciting passive support or non-interference. However, one thing that we can be certain of is that our enemies are just as active in this battle for the hearts and minds of the populace as we are. In many ways, the central government of a country is at a distinct disadvantage: the insurgent can promise the better way of life but the central government must show that it coming about; the insurgent can use terrorist and agitation tactics with relative impunity as compared with the probable results of any governmental "strong arm" measures; as the "underdog", the insurgent elicits much pity and support that is not given the government. Another problem that is particularly prevalent in the underdeveloped countries is a desire for growth accompanied by an unwillingness to accept growing pains. This point is well constructed in Millikan and Blackmer's book, The Emerging Nations:

"The mass media, bringing news and views of the world to illiterates in their urban slums and remote villages, introduce a new element into the process of modernization. People learn for the first time about the world outside their immediate environs, and their sense of life's possibilities begins to expand... One danger is that people will learn the fashions of popular participation long before the institutions of representative government are properly functioning. Then pseudo-participation takes command; that is, plebiscites that offer the form of public election without its substance, mob politics-of-the-street in which 'popular will' can destroy people and property without constructing better public policy. When exposure to the mass media overstimulates a people to this point, the leadership is pressed to give radio propaganda primacy over political economy. While

oratory resounds, development is likely to be shunted to the side and growth impeded. The result, for people led to impose demands which their transitional society cannot yet supply, may be a potentially explosive and spreading sense of frustration." 24

Our discussion of the target audience is purposefully general in nature. Those who are structuring specific psychological operations will need to explore the underlying considerations that make certain segments of the population better target audiences than others. Such considerations as the primary user of the "product" (e.g., It will be more important to insure that city dwellers understand that urban redevelopment programs are on the way than it would be to inform the inhabitants of the rural areas.) will help in identifying the target audiences that we most desire to reach. An initial breakdown of a country into demographic, economic and social groupings will simplify the problem of pinpointing specific target audiences for each propaganda theme that is to be used.

Measures of Success

Measuring success in psychological operations is much more difficult than its advertising counterpart. In advertising, a newly-marketed product costs X dollars to produce and promote, sells for Y dollars; hence, nets a profit of $Y - X$ dollars for each item sold. Profit goals, minimum number of years to obtain payback of investment, and other measures can be used as constraints in a study as to whether or not a particular product is to be marketed. In psychological operations we are most assuredly concerned with dollars but cannot use dollar profits as a measure of success. However, there are parallels between measuring success in a psychological

operation and measuring it in an advertising campaign. In a psychological operation:

1. Profit, though measured differently, is to be maximized.
2. Maximum advertising exposure is to be obtained (We are assuming that overexposure cannot occur.)
3. Both long run and short run goals should be established.
4. Real or imagined superiority of our "product", in comparison with other complementary "products" on the market, should be established.

One problem area that is not present is psychological as compared with big business operations is that of monopolistic practices. Big business must pay heed to anti-trust legislation; whereas, in psychological operations, a monopoly on the "hearts and minds" of the target audience is the desired result.

For the model presented in this paper we have simplified the problem of obtaining a measure of success. We do not attempt to measure the effectiveness of psychological operations as a whole. Rather, we only determine the number of people in each demographic, social, or economic grouping who are exposed to our propaganda and the number of times that they are exposed (termed frequency of exposure) over specified time intervals. This sub-optimization is still an important problem and is much more readily solved than would be an attempt to determine the overall effects of a propaganda campaign.

At the beginning of a propaganda campaign we will probably not have access to sufficient data regarding the number of people in each target audience segment who will have the physical opportunity of receiving a message. Hence, some methods need to be devised to effectively sample a population to determine these values (exposure ratings), by demographic, social, and economic groupings, for each type of media that we intend to use.

In 1964, Dr. Paitoon Cruagao, of the Asia Services Company Limited, conducted a study into the village channels of communication in Northeast Thailand. This method, along with comments appropriate to this paper, is described below:²⁷

1. Select hamlets, villages or some other groupings that are representative of various degrees of isolation. (This selection is stated in terms of isolation for simplification. A better way to determine the representative groupings might be to weight a combination of variables such as literacy rate, governmental support, insurgent support, isolation, etc.)

2. Divide the sample groupings into the demographic, social, and economic elements that we have determined to be of primary import. (These elements would be the ones discussed in the previous section on defining the target audience.)

3. Select random samples from each demographic, social and economic element that are large enough to insure significant results. (The level of significance specified

will normally be determined by such practical considerations as the time allotted to collect and process the data, the difficulty in obtaining the data, etc.)

4. Utilize pretested questionnaires and any other meaningful methods to determine the primary and secondary channels of communication within each demographic, social, and economic element. (By "channels of communication" is meant the means by which people receive information; e.g., a primary channel of communication might be newspapers whereas a secondary channel could be the husband telling his wife what he had heard during the day.) In Dr. Cruagao's study, "...Information was obtained through a pre-tested questionnaire; special interviews with priests, puyaibans, teachers, government officials and other leaders; and observation."

5. Extend the data obtained for each sample grouping to develop the exposure ratings for each media vehicle.

The initial data that would be obtained by using this approach could be less than satisfactory. One major reason for this is that in the first survey conducted within a country the exposure rating of the various media would usually be determined as a function of how the people were receiving general news and information; whereas, in follow-up surveys we would determine these ratings as they related to specific propaganda themes. Then, predicted exposure ratings could be compared with actual ratings and discrepancies noted. Thus, through successive surveys we could improve the overall reliability of our estimations.

In this chapter we have discussed some means of overcoming the difficulties inherent to defining a product, dealing with a diverse target audience, and measuring success in psychological operations. Next, we shall discuss the communication process and specify advantages and disadvantages in using each of the various types of mass media.

CHAPTER III

COMMUNICATION AND THE USE OF MASS MEDIA

"The use of mass psychoanalysis to guide campaigns of persuasion has become the basis of a multimillion dollar industry. Professional persuaders have seized upon it in their groping for more effective ways to sell us their wares -- whether products, ideas, attitudes, candidates, goals, or states of mind.²²

To develop an understanding of what is referred to above as "mass psychoanalysis", we must first look at the basic communication process; then, we can discuss the varying effects and interactions between the different types of mass media.

The Communication Process

Functionally, communication is composed of a source, a message, and a destination. The source can be an individual or an organization such as Radio Free Europe. The message can take any form that is capable of being interpreted in a meaningful manner. We define the form that the message takes as the signal. In one case it may be ink on paper; in another, it could be something as simple as the V for victory sign that was used during the Second World War. The destination is always individuals who may be alone or in groups such as lecture, radio or newspaper audiences.

The communication process can be represented schematically as shown in Figure I. In electronic communication, the encoder would be a microphone and the decoder an earphone. In human communication, the source and encoder would be one



Figure I

The Communication Process

person, the signal would be the language spoken, and the person being spoken to would be the decoder and destination.

All psychological operations involve the communication process. This is obvious when referring to transmitted propaganda messages. However, it is equally true in the case where actions or demonstrations are conducted to reap psychological gains. The protest marches conducted by the late Dr. Martin Luther King, Jr. can be construed as a type of psychological operation. Yet, if these marches had been performed in the desert, and if they had been unpublicized (i.e., not communicated to the public), then they would probably have been ineffective. Thus, the communication process can be no more effective than its weakest link permits:

1. The source should have sufficient, believable, and understandable information.
2. Encoding should be complete, accurate and transmittible.
3. Transmission needs to be timely and undistorted, irrespective of attempted interference.
4. Decoding must correspond exactly to the encoding.

5. The destination must be capable of producing the desired result.

Hence, for a communication process to be successful each of its components must be highly reliable. For example, if each component of a communication process was ninety per cent reliable (i.e., ninety per cent of the information from the source would be sufficient, believable and understandable; ninety per cent of the time the encoding would be complete, accurate, and transmittible; etc.); then, the overall reliability of this communication process would be 59.05 per cent, (the product of the individual reliabilities). This figure may seem low, but when we consider the many variables that affect the communication process we begin to realize that one may be doing well if he can keep reliability above the fifty per cent level.

As we discussed in the previous chapter, feedback from the target audience is necessary to effectively measure the reliability of a communication process. In the case of what we shall term "face-to-face discourse", the problem of feedback is greatly simplified in that we can see the expressions of our audience and can hear their grumbles or assenting applause. On the other hand, feedback is not as readily obtained from mass communication forms such as radio, newspapers, etc. In these cases, one cannot see the target audience to obtain immediate reactions. However, the overall success of our communication can sometimes be inferred by determining the number of people that "tune in" on the media that we are using. If we are using radio broadcasts and find

that our radio audience has diminished by 100,000 people we would infer that something has gone wrong with our communication. It would then be necessary to determine which "link in the chain" is weak. For example, in the Korean War, the Communists seized Seoul and confiscated all radio receivers, even though they had control of Seoul radio station, the most powerful one in the area. In this way, they denied free world radio communication to all but the brave few who had satisfactorily hidden their receivers. (It should be noted that this was done at the expense of losing their own capability to use radio in transmitting communist propaganda to the South Koreans.) In this example, the "weak link" was determined to be maximal interference (the confiscating of the radios). Therefore, we might have improved our communication with the South Koreans by intensifying the use of some other communication media such as leaflets.

No matter how primitive or oppressed a society is, there will normally be more communication presented to it than can possibly be received by everyone. We can only listen to one radio station at a time and can only read so much material in a day. If we assume that man has some choice in selecting the offerings of mass communications, we can define,

$$\text{Selection Coefficient} = \frac{\text{Expectation of Reward}}{\text{Effort Required to Receive Message}}$$

where both the expectation of reward and the effort required are scaled on the interval 1 - 100. This selection coefficient will vary from person to person and from one target audience to another. Hence, communicators (propagandists, of

course included) should attempt to make it easy and beneficial for a target audience to "tune in". That is, they want to decrease the effort required to receive a message and increase the expectation of reward that will accrue from having received it. The problem of increasing the expectation of reward is primarily one of message content. We shall not discuss it further since the model to be discussed in this paper considers message content as a constant. On the other hand, decreasing the effort required to receive a message is highly dependent on the media used to propagate it. (As was mentioned in the example regarding the Korean War, the effort required to receive a message by radio was great whereas it might have been considerably reduced by using another type of media.) For this reason, we shall discuss the types of mass media in some detail.

The Mass Media

Numerous studies have been conducted to test the effects of the various forms of mass media on the understanding and retentive capabilities of a target audience. Such studies and experiments should be interpreted carefully. Laboratory tests may suggest that television is the most effective means of electronic communication. However, this result would prove to be virtually meaningless if the "real world" audience with which we wished to communicate had different characteristics than the "test" audience; or, in the extreme, if there was only one television set per million people in the "real world" audience. The point to be made is that laboratory results do not necessarily reflect "real world"

happenings. There is no hard and fast set of rules to govern choice of media. The attributes and drawbacks of the various forms of mass media will take on different values for different target audiences. For instance, depth of treatment is considered to be one of the attributes of print, but this "attribute" would be of minimal import if the target audience was illiterate. Hence, the general considerations of each form of mass media discussed below should be interpreted liberally.

Face-to-Face Discourse

Almost all studies on the subject of advertising or psychological operations are in agreement that face-to-face discourse is the most effective individual instrument of persuasion. The following psychological advantages are considered to be the primary reasons for its success:

1. It is more casually engaged in and will often attract an audience that would not trouble itself to receive the same information by other forms of mass communication.
2. The perpetrator of face-to-face discourse can mold his manner of presentation to suit a particular target audience. In this way, he can largely reduce resistance to his message.
3. By expressions of pleasure or displeasure, the target audience can be rewarded or punished for their reaction.
4. The source of face-to-face discourse may be a trusted or intimate friend of the target audience from whom information is believable; e.g., a clergyman.

5. It is sometimes possible to accomplish objectives without first instilling conviction. For instance, if the leader of a local young men's organization tells its members to sign up for service in the militia, some may join just to keep from discrediting themselves in the eyes of their leader.

We recognize that there are many cases when face-to-face discourse is not a practical method of communicating with a target audience. It would hardly be worthwhile for the United States to try to infiltrate men behind the "Iron Curtain" or into Communist China to start a program of face-to-face confrontations on the evils of communism and benefits of "free world" life. The costs would be great and the gains comparatively small. The Nationalist Chinese have on occasion attempted to infiltrate men into the mainland of China to instigate dissatisfaction in the populace. In every recorded case they have been captured almost immediately upon entering the country.²³ (We pre-suppose that the people of Communist China are more afraid of the consequences of not reporting an intruder than they are willing to chance a possibility of bettering their way of life; that is, the expectation of reward is negligible as compared to the effort required.)

Face-to-face discourse may also be considered to include the spectrum of discussions that take place daily throughout the world. Tests have shown that casual conversations, as differentiated from formal addresses, are

potentially more influential than any form of formal communication.²³ For this reason, the proponents of a propaganda campaign should be careful not to alienate any major faction of the target audience, for the initial harm done could be greatly magnified through dissemination of discontent from that portion of the target audience alienated.

Radio

In the recent past, radio has proved to be an efficient means of mass communication to various target audiences. In the field of psychological operations, Radio Free Europe and The Voice of America have been broadcasting for years in an effort to "educate" peoples of the Communist world. The advantages of radio include:²

1. The number of people that can be reached at one time is usually large.
2. The propagandist can gain a nation-wide audience by using networks or by increasing the power of his transmitter. He can also pinpoint a specific target audience by properly establishing a low-power transmitter.
3. Audience selectivity can also be gained by scheduling at different times and by use of different types of radio programs.
4. It has a special persuasive quality as a companion, a friend, and a prime source of information for the listener.

When we consider the use of radio in communicating with a target audience we should not only be concerned with the present density of radios within the population. We should also project the costs and benefits that would accrue if we were to distribute radios to members of the population. In some cases it may be more cost-effective to give ten or twenty radios to every village within a country than it would be to attempt to communicate with the people by any other means. Of course, if we are considering giving away radios we must also consider that our intended audience may, in fact, use the radios to tune in on our enemies.

Print

The printed word, whether it be in the form of newspapers, magazines, leaflets, or any other form, has distinct advantages over the other types of media. The primary ones are:²³

1. The reader is able to pace himself as he desires. He can ponder over important points and skip those that hold no interest for him.
2. Printed matter remains available for the reader to peruse for months or even years after the initial reading.
3. Difficult or complex topics can be treated in depth for the reasons given in (1) and (2) above.
4. It is possible to specialize appeals by utilizing the knowledge that certain people read particular

types of magazines or sections of the newspaper.

5. Print may have greater prestige than the other forms of mass media. This is attributed to the fact that it is one of the oldest of the mass media and that print and "culture" have been traditionally associated.

A recent radio advertisement stated, "Montaigne once wrote, 'What do we do about those people who will not believe anything unless they see it in print?'" The advertisement went on to give the answer, "Print it, of course." As one might guess the advertisement was for a printing and lithographic company. However, it is probably true that some of these people who will not believe anything unless they see it in writing, will believe anything that is written.

When planning the use of print, we must take into account the literacy of the target audience. (The fact that a certain audience may be illiterate may not negate the use of print but it will certainly affect the amount of pictorial or symbolic material required.) We also need to consider the ease of dissemination. If we control the press it will certainly be much easier to reach the people than if we have to rely on covert publications or leaflet drops.

Screen

When we consider the use of screen, television or movies we are implicitly assuming that our audience is indigenous to a country in which we have some degree of

control. The present state of the art in television is such that signals cannot be projected satisfactorily over great distances without a purposeful receiving station in the proximity of the target audience. Further, a television signal is considerably easier to "jam" and the prevalence of television sets in the areas of the world that are of major concern in our propaganda efforts is low. Likewise, there is little opportunity to show movies favorable to the "free world" in such countries as Cuba, Russia or Communist China. Hence, the benefits that we ascribe to the screen are greatly diluted by the opportunity for its use. The benefits are:²

1. Concrete visual material is presented.
2. Recall of what has been seen is generally excellent.
3. Children are particularly impressed by what they see.

Interactions Among Mass Media

Almost every propaganda campaign will include the use of more than one type of media to communicate with the target audience. If the target audience receives the same message by more than one medium his belief in what he is receiving will normally be fortified. However, if different messages relating to the same incident or different interpretations on a particular propaganda theme are received via two different media; then, the target audience becomes confused, probably believes neither message,

and loses some faith in both media. Credibility is hard to establish initially, but virtually impossible to re-establish once it is lost; hence, a cardinal rule for the use of mass media is to be consistent in all communication.

Thus far in this paper the stage has been set to present a model that can be used in optimizing allocation of the various forms of mass media. We have discussed how the product, target audience, measures of success and forms of mass media can be characterized in psychological operations. In the next chapter, we shall describe the formulation of the model and present an application of its use in psychological operations.

CHAPTER IV

PROBLEM FORMULATION AND DEVELOPMENT

OF A GOAL PROGRAMMING MODEL

In this chapter we shall formally set forth the problems that face the decision maker who is attempting to optimize a media mix for a given psychological operation. Then, a "goal programming" model (which closely parallels one that was developed for marketing by A. Charnes, W. W. Cooper, J. K. DeVoe, D. B. Learner and W. Reinecke³⁰) will be presented that will allow determination of the "best" possible use of available media subject to specified budget restrictions, resource limitations and desired levels of achievement with respect to each target audience of concern.

Problem Formulation

The overall problem that is addressed by the model to be presented is that of staying within a fixed budget while at the same time subjecting to propaganda those people whom we specifically desire to receive a message a given number of times in certain time periods. This is a complex problem and we will approach it by subdividing it into a number of interrelated problems, the intersection of which is equivalent to the original problem. Then, by formulating a method to solve concurrently this set of problems we will guarantee solution to their intersection, the original problem.

Before stating the subdivisions chosen, it is well to summarize the information that should be obtained as data inputs to the model. We will need to determine:

1. The most representative groupings into which the total population of a country can be divided.

2. The number of people in each of these groupings.

3. The geographic subdivisions that are most representative of a country.

4. The density of each grouping in each of the chosen geographic subdivisions.

5. The primary and secondary means by which each grouping receives information.

6. The media that are available internally and externally for use in the country of concern.

7. The cost per publication, broadcast, etc.

8. How often and when each medium is presently used.

9. How often it is possible to use each medium.

10. The savings that accrue through larger purchases of each type medium.

11. The breakdown, by grouping, of the number of people that are subject to transmissions of each possible medium.

12. The budget restrictions that exist.

13. Any special commitments that require use of certain media a specified number of times.

Once this data has been obtained the planners for the psychological operation can structure a set of goals, the simultaneous attainment of which is their objective. To be more precise, the problem as originally stated is subdivided into one of minimizing the variance, subject to a given budget, between goals stated with respect to specified target audiences over both time periods and time intervals (e.g., three monthly time periods make one quarter-year interval). Further, the goals, themselves, can be formed with respect to the total number of times members of a given target audience are to be subjected to propaganda, the percent of each target audience that is to be subjected, and the distribution of the frequencies of subjection. However, in order to simplify the formulation of the model we will develop it with respect to one target audience.

As one may surmise, it will be quite possible to form a set of goals that cannot be simultaneously satisfied, i.e., there might not be a feasible solution to the problem. In these cases, as will be shown, a "best possible solution" is obtained by minimizing the variance from the stated goals, i.e., by "goal programming".

The first step in developing this goal programming model will be to define and quantify methods by which goals can be represented as linear constraints. Specifically, a means of representing the gross target audience, the net target audience and the distribution of times that members of the net target audience are subjected to propaganda will be presented. Then, we shall demonstrate the use of goals and

other constraints, such as budgetary limitations, in forming a goal programming model. Finally, a numerical example will be given.

The Gross Target Audience

During time period t , we might choose to transmit propaganda several times over a given medium. This choice may be represented by the decision variable $x_{jk}(t)$, which would take the value $x_{jk}(t) = 1$ if we chose to use medium j exactly k times during time period t , and would have the value $x_{jk}(t) = 0$ otherwise. To simplify the linear programming techniques required, the restriction on the $x_{jk}(t)$ can be approximated by requiring

$$\sum_k x_{jk}(t) \leq 1 \quad (1)$$

where

$$x_{jk}(t) \geq 0 \quad .$$

Suppose that we elect to use the j^{th} medium k times in time period t ; i.e., $x_{jk}(t) = 1$. If U is the set of N people representing our target population, then this decision would mean that a subset $u_{j1}(t)$ of $n_{j1}(t)$ people in our target population would be exposed to the propaganda the first time we used the medium, a subset $u_{j2}(t)$ of $n_{j2}(t)$ people would be exposed the second time we used the medium, and a subset $u_{jk}(t)$ of $n_{jk}(t)$ people would be exposed the k^{th} and final time we used the medium in period t . Note that these subsets are not disjoint, in that a given individual may be subjected to propaganda 2, 3, or possibly k times by medium j during time

period t . We define

$$d_{jk}(t) = \sum_{i=1}^k n_{ji}(t)$$

as the total number of exposures from medium j in time period t resulting from our decision to set $x_{jk}(t) = 1$. For example,

$$d_{34}(6) = 25,000$$

would imply that by propagating medium three (say, National Magazine), four times in a six-month period, we would subject to propaganda 25,000 members of the target audience, (say, men aged 20 - 25).

The gross target audience for time period t , $D(t)$, is defined as the number of exposures to propaganda by all media in the time period, and can be represented by

$$D(t) = \sum_j \sum_k d_{jk}(t) x_{jk}(t) \quad (2)$$

For example, the matrix

$$\begin{aligned} \left\| d_{jk}(t) \right\| &= \begin{bmatrix} d_{11}(t) & d_{12}(t) \\ d_{21}(t) & d_{22}(t) \end{bmatrix} \\ &= \begin{bmatrix} 200 & 300 \\ 250 & 350 \end{bmatrix} \end{aligned}$$

would imply that in time period t , 200 people would be subjected to propaganda by one transmission of medium 1, 300 people would be subjected to propaganda by two transmissions of medium 1, etc.

Likewise,

$$\begin{aligned} \left\| x_{jk}(t) \right\| &= \begin{bmatrix} x_{11}(t) & x_{12}(t) \\ x_{21}(t) & x_{22}(t) \end{bmatrix} \\ &= \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \end{aligned}$$

would imply that in time period t , medium 1 was utilized exactly twice ($x_{12}(t) = 1$) and medium 2 utilized exactly once ($x_{21}(t) = 1$). Hence, the total gross target audience subjected to propaganda by media 1 and 2 during period t would be

$$\begin{aligned} D(t) &= \sum_{j=1}^2 \sum_{k=1}^2 d_{jk}(t) x_{jk}(t) , \\ &= (200)(0) + (300)(1) + (250)(1) + (350)(0) , \\ &= 550 \text{ people.} \end{aligned}$$

It is noted again, that gross target audience is determined without regard to duplication. Hence, in the above example there are not necessarily 550 different people subjected to propaganda.

The Net Target Audience

We have seen that if we use the j^{th} medium k times during the t^{th} time period ($x_{jk}(t) = 1$), the total number of exposures is given by

$$d_{jk}(t) = \sum_{i=1}^k n_{ji}(t) .$$

The actual number of people, $N_{jk}(t)$, subjected to propaganda at least once by medium j during period t will be the number

of people in the union of the sets; $u_{ji}(t)$, $i=1,2,\dots,k$.

Let $r_{jk}(t)$ be the proportion of the target audience U (of size N) that is subjected to propaganda at least once from medium j during time period t . Then,

$$r_{jk}(t) = \frac{N_{jk}(t)}{N},$$

and we can compute

$$1 - r_{jk}(t) = \prod_{i=1}^k \left(1 - \frac{n_{ji}(t)}{N}\right)$$

or

$$r_{jk}(t) = 1 - \prod_{i=1}^k \left(1 - \frac{n_{ji}(t)}{N}\right).$$

We define the net target audience, $N(t)$, as the total number of people in the target audience, U , that are exposed to propaganda by any medium at least once during time period t . The proportion of the total target audience subjected to propaganda at least once in period t is

$$R(t) = \frac{N(t)}{N}$$

and, if we assume the $r_{jk}(t)$ to be independent and require $x_{jk}(t)$ to conform to (1) for each t , it can be computed by

$$1 - R(t) = \prod_{j,k} (1 - r_{jk}(t))^{x_{jk}(t)} \quad (3)$$

where $(1-R(t))$ is the proportion of the total target audience that is not subjected to propaganda during period t . Using the example mentioned earlier, if out of a total target audience, 80 per cent are subjected twice to medium 1 and 60

per cent subjected once to medium 2 during period t , then

$$\begin{aligned}
 1 - R(t) &= \prod_{j=1}^2 \prod_{k=1}^2 (1 - r_{jk}(t))^{x_{jk}(t)}, \\
 &= (1 - r_{11}(t))^0 (1 - 0.80)^1 (1 - 0.60)^1 (1 - r_{22}(t))^0, \\
 &= 0.08
 \end{aligned}$$

which indicates that 92 per cent of the total target audience is subjected to propaganda at least once, by media 1 and 2, during time period t .

To convert (3) into a form compatible with linear programming we utilize logarithms to obtain :

$$\ln(1 - R(t)) = \sum_j \sum_k \ln[1 - r_{jk}(t)] x_{jk}(t). \quad (4)$$

Distribution of Frequencies

One means of dealing with the problem of estimating the number of times a target audience is subjected to propaganda is to use average frequency (gross target audience divided by net target audience). A drawback to this approach is that it denies the ability to pinpoint that proportion of a target audience that is subjected to propaganda a specific number of times. However, there is a method which was developed for use in advertising that makes use of the log-normal distribution as an approximating device for estimating an entire distribution of frequencies.³³ This same method can be applied in psychological operations.

Let $H_s(t)$ be the proportion of the net target audience that is subjected to propaganda s or more times in period t .

Thus, if Figure II represents the frequency diagram for a given net target audience, we see that

$$H_1(t) = 1.0 ,$$

$$H_2(t) = 0.60 ,$$

$$H_3(t) = 0.40 ,$$

etc.,

which implies that for the net target audience represented, 40 per cent are subjected to propaganda exactly once, 20 per cent exactly twice, etc.

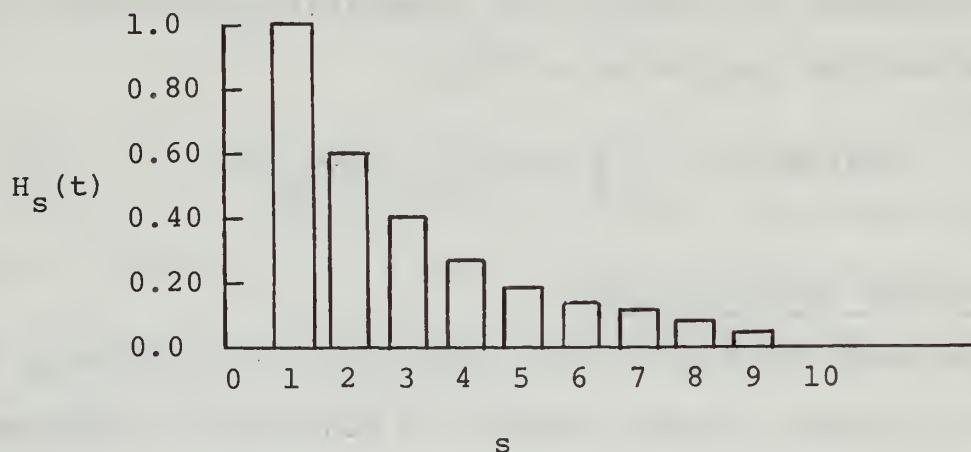


Figure II

Sample Frequency Diagram

As we previously stated, the log-normal distribution is considered a sufficiently accurate representation of the distribution of frequencies. Let $\mu^*(t)$ and $\sigma^*(t)$ be the mean and standard deviation of the log-normal distribution, and let $\mu(t)$ and $\sigma(t)$ be the mean and standard deviation of the associated normal distribution. Then

$$\mu(t) = 2 \ln \mu^*(t) - \frac{1}{2} \ln [\sigma^*(t)^2 + \mu^*(t)^2]$$

and

$$\sigma^2(t) = \ln[\sigma^*(t)^2 + \mu^*(t)^2] - 2 \ln \mu^*(t) \quad .$$

However, experimentation has shown that these exact relationships between the parameters of the normal and the log-normal distributions should be replaced by suitable approximations.³⁰

Let A_m , B_m , C_m , D_m and E_m be parameters whose values would either be estimated empirically or approximated for each type of m types or combinations of media. Recalling that N is the total number of people in a specific target audience and defining $P_j(t)$ to be the proportion of the target audience subjected to propaganda by the first transmission of medium j , then

$$P_j(t) = \frac{d_{j1}(t)}{N}$$

and we may write expressions for the relationships between the mean and variance of the normal and log-normal distribution as³³

$$\mu(t) = A_m + B_m \sum_j \sum_k P_j(t) x_{jk}(t) + C_m \sum_j \sum_k k x_{jk}(t)$$

and

(5)

$$\sigma(t) = D_m + E_m \sum_j \sum_k k x_{jk}(t) \quad .$$

In the above expressions, $\sum_j \sum_k P_j(t) x_{jk}(t)$, represents the proportion of the target audience that is subjected to propaganda by all first transmissions and $\sum_j \sum_k k x_{jk}(t)$ counts the total number of times propaganda is transmitted by all media.

Correspondence with the discrete distributions is obtained by the expression

$$Z_{(1-H_s(t))} = \frac{\ln(s-F_m) - \mu(t)}{\sigma(t)} \quad (6)$$

where Z is the studentized normal variate, $N(0,1)$, and F_m is another parameter whose value is determined empirically for each of m types or combinations of media. Now, since Z is the fractile associated with $1 - H_s(t)$ for $N(0,1)$, we can substitute the values of $\mu(t)$ and $\sigma(t)$ from (5) into (6) to obtain

$$Z_{(1-H_s(t))} = \frac{\ln(s-F_m) - A_m - B_m \sum_j \sum_k P_j(t) x_{jk}(t) - C_m \sum_j \sum_k k x_{jk}(t)}{D_m + E_m \sum_j \sum_k k x_{jk}(t)} \quad (7)$$

Specification of Goals

Goals can be formulated with respect to both the gross and net target audience. If it is desired that the gross target audience for period t be at least $L(t)$ people, then from (2) we can require

$$D(t) \geq L(t)$$

or equivalently

$$\sum_j \sum_k d_{jk}(t) x_{jk}(t) \geq L(t) ,$$

where the values of $L(t)$ will be varied to account for seasonal limitations or other environmental factors that make the desired goals in time period one different from those in some other time period. In addition to our time period constraints we can also specify goals for specified time intervals such as requiring that the gross target audience for T time

intervals be at least $L(T)$. That is, if time periods are of length one month and T is a three month or quarterly interval, we could state the quarterly goal as

$$\sum_{t=1}^3 \sum_j \sum_k d_{jk}(t) x_{jk}(t) \geq L(T).$$

In establishing constraints or goals with respect to the net target audience we might require that the proportion $R(t)$ of the total target audience subjected to propaganda at least once in period t , $R(t)$, be greater than some prescribed percentage of the net target audience, $N(t)$; that is,

$$R(t) \geq N(t),$$

which implies

$$\ln(1-R(t)) \leq \ln(1-N(t)) .$$

Then, the linear constraint,

$$\sum_j \sum_k \ln [1-r_{jk}(t)] x_{jk}(t) \leq \ln(1-N(t))$$

is formed from (4). Once again, we could also specify constraints over selected time intervals; i.e.,

$$\sum_{t \in T} \sum_j \sum_k \ln [1-r_{jk}(t)] x_{jk}(t) \leq \ln(1-N(T)).$$

At this point, it is well to note that it may be difficult to obtain the values for all the $r_{jk}(t)$. However, those that are not known can be generated if values for $r_{j1}(t)$ and any other $r_{jk}(t)$ can be obtained. To do this we substitute the known values into

$$r_{jk}(t) = r_{j1}(t) + a_j(t) \ln(k) \quad (8)$$

and solve for the $a_j(t)$. Then, by substituting the $a_j(t)$ back into (8), the unknown values of $r_{jk}(t)$ can be obtained.³³

In stating goals for the distribution of frequencies, it could be specified that $(100)q$ per cent of the net target audience be subjected to propaganda at least q times in time period t , or

$$H_g(t) \geq q$$

which is equivalent to

$$1 - H_g(t) \leq 1 - q.$$

Then, if Z is the fractile associated with $1 - H_g(t)$ for $N(0,1)$, we can write

$$Z_{(1-H_g(t))} \leq [Z_{(1-q)} = \Phi^{-1}(1-q) = Q]$$

where Φ is the distribution function for $N(0,1)$. Now, constraints of this type can be succinctly stated by using (6),

$$\frac{(\ln(q-F_m) - \mu(t))}{\sigma(t)} \leq Q$$

or by substituting into and performing algebraic rearrangement on (7) to obtain,

$$(C_m + E_m Q)k \sum_j \sum_k x_{jk}(t) + B_m \sum_j \sum_k P_j(t) x_{jk}(t) \geq \ln(q-F_m) - A_m - D_m Q.$$

We have implicitly assumed that we have been able to determine values for the parameters, A_m through F_m . The advertising firm that is presently employing the model upon which this one is based has tried a number of approximating techniques for determining these values for each type and combination of media.³⁴ The most successful has been to generate the values A_m through E_m by using a form of linear regression to fit

$\mu(t)$ and $\sigma(t)$ to empirical data. Likewise, the value of F_m is determined so that it best fits (6) to experimental results. However, in planning psychological operations we will probably not have the data gathering resources equivalent to those available for advertising studies in the United States. Hence, the initial evaluation of the parameters A_m through F_m would be based on relatively small samples or on values that were determined appropriate for use in another operation. These initial values would need to be verified and, if necessary, updated as soon as reliable feedback is obtained.

In addition to the constraints that have been stated thus far we will also need to specify budget limitations, maximum possible or desired use of each type of media and any other special limitations that may be indigenous to the area in which we are operating.

The overall budget limitation would be

$$\sum_j \sum_k c_{jk}(t) x_{jk}(t) \leq \text{total budget}$$

where the $c_{jk}(t)$ are the costs for k insertions (where an insertion is the planting of a propaganda message in one issue, radio show, etc.) in media vehicle j during time period t and $x_{jk}(t)$ is required to conform to (1). Any special budgetary limitations, such as required expenditures on a certain type of media because of past commitments, can be translated into equations similar to equation (9).

Upper and/or lower bounds on the number of insertions in a certain class of media or in a specific media vehicle are governed by factors such as the number of issues published or

by the number of hours of radio transmissions possible in a certain time period. For instance, if we were considering a weekly newspaper we must constrain the number of insertions possible to 52 per year; that is,

$$\sum_{t \in T} \sum_k kx_{8k}(t) \leq 52, \quad t=1,2,\dots,52,$$

where the subscript, $j = 8$, refers to this specific weekly newspaper and T is one year. Similarly, if it was mandatory that at least two radio broadcasts be given in time period t , we would specify the constraint as

$$\sum_k kx_{9k}(t) \geq 2,$$

where the subscript, $j = 9$, refers to the specific radio station.

Up to this point we have confined ourselves to formulating methods of dealing with the various constraints that may be given for a certain propaganda campaign. We turn now to a branch of linear programming, termed "goal programming", as the method by which we optimize our actions subject to a set of specific constraints.⁹

Formulating the Goal Program

Basically, "goal programming" allows us to solve unsolvable problems. That is, through iterative techniques we drive our solution to a point that may not be optimal, in the true sense of the word, but is the best that we can do under the restrictions that are placed upon us. (There is no better solution than the one that is obtained.) The constraints that we shall incorporate in the functional to be formed can

be considered goals. Goals that are not attainable will generally have been established as incentive measures, methods by which accomplishments can be evaluated, or as a means of insuring that long-run objectives are not overlooked in obtaining short-run success.

In forming the "goal program" we consider three types of constraints:

First, there are those constraints which must be satisfied in the solution; e.g., budget restrictions. Normal slack vectors are associated with these constraints. For example, the overall budget constraint can be written as

$$\sum_j \sum_k c_{jk}(t)x_{jk}(t) + S_1 = \text{total budget} \quad (10)$$

where S_1 is a slack vector of the type that is normally used in linear programming.

A second type of constraint is one where a goal is specified that is attainable if considered independently of other goals but may not be attainable when considered as a member of the entire system of constraints. In this case, we allow the specified goal to be either exceeded or not reached by an amount that will allow a "best possible solution" for the entire system. For example, the budget and resource constraints may be such that it is possible to subject to propaganda at least $L(t)$ members of the gross target audience (neglecting other goals) for all t , $t=1,2,\dots,T$. Then, this constraint would be written as

$$\sum_j \sum_k d_{jk}(t)x_{jk}(t) + S_2^+ - S_2^- = L(t)$$

where the terms S_2^+ and S_2^- indicate that this goal is best satisfied by minimizing the absolute value of S_2 . (Obviously, both S_2^+ and S_2^- cannot appear at a positive level in the final basis. This fact is guaranteed by the linear independence of the basis vectors in the simplex method of linear programming.)

A third type of constraint that may enter the goal program is one that is known to be unattainable given specified budget and resource limitations. For instance, if we know that it is not possible to reach a proportion equal to $N(t)$ of the target audience for at least some t , we would state this constraint as

$$\sum_j \sum_k \ln[1-r_{jk}(t)]x_{jk}(t) - S_3^- = \ln(1-N(t)) \quad (12)$$

where S_3^- is the amount by which we miss attaining this goal.

To demonstrate the formulation of the entire "goal program" we will consider that equations (10), (11), and (12) are the goals that we have been directed to satisfy in conducting some psychological operation. We will also consider that the rather ill-defined term, "as close as possible", is satisfied by minimizing the sum of the absolute deviations of each of the goal constraints. That is, we can define a function, $d(x,y)$, to be the "distance" (or, metric) in a general vector space with properties:

$$d(x,y) \geq 0 \text{ and } d(x,y) = 0 \text{ iff } x = y;$$

$$d(x,y) = d(y,x);$$

$$d(x,y) \leq d(x,z) + d(z,y).$$

Then, the measure of the mean deviation (or ℓ_1 metric) is defined as

$$d(x,y) = \sum_j |x_j - y_j|.$$

Hence, for our illustrative "goal program" the objective function will be

$$\begin{aligned} \min. & \sum_j \left| \sum_k d_{jk}(t) x_{jk}(t) - L(t) \right| \\ & + \left| \sum_j \sum_k \ln[1 - r_{jk}(t)] x_{jk}(t) - \ln(1-N(t)) \right| \end{aligned}$$

or equivalently,

$$\min. z = S_2^+ + S_2^- + S_3^- ,$$

since each of the terms in (13) is required to be non-negative. Therefore, the entire "goal program" (neglecting any resource constraints) can be written as:

$$\min. z = S_2^+ + S_2^- + S_3^- ,$$

$$\text{S.T. } \sum_j \sum_k c_{jk}(t) x_{jk}(t) + S_1 = \text{total budget},$$

$$\sum_j \sum_k d_{jk}(t) x_{jk}(t) + S_2^+ - S_2^- = L(t) ,$$

$$\sum_j \sum_k \ln[1 - r_{jk}(t)] x_{jk}(t) - S_3^- = \ln(1-N(t)) ,$$

$$\sum_k x_{jk}(t) + S_4 = 1 ,$$

and

$$S_1, S_2^+, S_2^-, S_3^-, S_4, r_{jk}(t), x_{jk}(t), L(t), N(t) \geq 0, \forall j, k.$$

This concludes the formulation of a "goal programming" model that can be used to project the "best possible" use of available media to achieve specified objectives given budget and

resource constraints. Next, the use of the model will be demonstrated in a numerical example.

Hypothetical Application of the Model

The situation and values used in this application of the model will be fictitious; however, an attempt has been made to make them realistic. It is also noted that this example use of the model will be greatly simplified from that which would be expected to occur in actual practice in order to facilitate a better understanding of the rudimentary aspects of the model. Hence, only one target audience and two choices of media will be considered.

As a scenario, we assume that the United States was called upon by Frebia, a member of the SEATO alliance, to assist them in overcoming the first phase of a Communist-inspired insurgency. One portion of the support given by the United States was in the form of a team of advisors in the field of psychological operations. This team (which included "experts" on the political, cultural, sociological and economic concerns of Frebia) moved to Frebia and in conjunction with Frebian government officials determined that one of the major problem areas in Frebia was a lack of nationalistic spirit, especially among the young men of the country. It was decided to launch an extensive psychological operations campaign aimed at inspiring a nationalistic feeling in the men, aged 20 - 25. A budget limitation of \$11,000 was placed on this goal.

The first step in using the model presented in this paper was to define the product which in this case was determined to

be "Nationalism". Next, extensive surveying and data gathering were conducted in three villages that were representative of three degrees of isolation from the central government. From the data obtained it was determined that the two best means of communicating with the primary target audience, men between the ages of twenty and twenty-five, was Radio Frebia (a weekly radio broadcast) and National Frebian (a bi-weekly magazine). The latest census indicated that the total number of people in this target audience, N , was 70,000. Multiple regression was used to fit $\mu(t)$ and $\sigma(t)$ from (6) to the applicable data that had been obtained from the three villages. The parameters A_m through F_m were determined to have the following values for both Radio Frebia and National Frebian: (Since both were determined to have the same values, we shall drop the subscript, m .)

$$\begin{aligned} A &= 0.057 \\ B &= 0.020 \\ C &= 0.002 \\ D &= 0.015 \\ E &= 0.135 \\ F &= 0.850 \end{aligned} .$$

Next, the costs shown in Table I were obtained from the media publishers and the data shown in Table II determined from the representative samples taken in the three villages for a one month time period, $t = 1$.

Table I

Sample Media Costs

Media	j	Cost per Insertion	Max Insertions per Month
Radio Frebia	1	\$1000.00	2
National Frebian	2	\$3000.00	4

Table II

Sample Gross and Net Target Audience Data

Media	j	$r_{j1}(1)$	$r_{j2}(1)$	$d_{j1}(1)$	$d_{j2}(1)$	$d_{j3}(1)$	$d_{j4}(t)$	$P_j(1)$
Radio Frebia	1	0.25	0.43	20,000	38,000	-	-	0.286
National Frebian	2	0.40	0.55	30,000	55,000	72,000	80,000	0.429

Recall that

$$r_{12}(1) = 0.55$$

implies that the proportion of people in the total target audience ($N = 70,000$) obtained by the second transmission ($k=2$) of medium 1 (Radio Frebia) in one month ($t=1$) is 0.55 and that

$$d_{23}(1) = 72,000$$

indicates that there have been 72,000 exposures to the target audience (where obviously, some have been subjected to propaganda more than once, since $N = 70,000$) via three

transmissions ($k=3$) of National Frebian ($j=2$) in one month ($t=1$). The proportion of the total target audience subjected to propaganda by the first transmission of j in a one month period, $P_j(1)$, was found using

$$P_j(1) = \frac{d_{j1}(1)}{N} .$$

We also have sufficient data to determine the missing proportions, $r_{23}(1)$ and $r_{24}(1)$. First we solve for $a_2(1)$ in (8). Thus,

$$r_{22}(1) = r_{21}(1) + a_2(1)\ln 2$$

which, by substituting values from Table II gives

$$\begin{aligned} a_2(1) &= (0.55-0.40)(\ln 2)^{-1}, \\ &= 0.2164. \end{aligned}$$

Then,

$$\begin{aligned} r_{23}(1) &= r_{21}(1) + a_2(1)\ln 3, \\ &= 0.638 \end{aligned}$$

and

$$\begin{aligned} r_{24}(1) &= r_{21}(1) + a_2(1)\ln 4, \\ &= 0.700. \end{aligned}$$

The goals specified by the psychological operations team, as recommended by the Frebian government, are as follows.

1. The proportion of the target audience subjected to propaganda at least once during one month should be greater than or equal to 0.75. That is

$$R(1) \geq [N(1) = 0.75]$$

or, from (12)

$$\sum_{j=1}^2 \sum_{k=1}^4 \ln[1-r_{jk}(1)]x_{jk}(1) + s_1^+ - s_1^- = \ln(1-.75) .$$

2. The gross target audience subjected to propaganda during a one month period should be at least 110,000. Then,

$$D(1) \geq L(1) = 110,000$$

or, from (11),

$$\sum_{j=1}^2 \sum_{k=1}^4 d_{jk}(1)x_{jk}(1) + s_2^+ - s_2^- = 110,000.$$

3. At least 80 per cent of the net target audience should be subjected to propaganda at least three times in a one month time period. That is

$$H_3(1) \geq [q = 0.80]$$

which implies

$$Z_{(1-H_3(1))} \geq [Q = Z_{(1-0.8)} = Z_{0.2} = \Phi^{-1}(0.2) = 0.84].$$

Now, from (6) we have

$$\frac{\ln(3.0-F) - \mu(1)}{\sigma(1)} \geq (Q = 0.84)$$

so, from (7) we can write this goal as

$$\begin{aligned} (C + EQ) \sum_{j=1}^2 \sum_{k=1}^4 kx_{jk}(1) + B \sum_{j=1}^2 \sum_{k=1}^4 P_j(1)x_{jk}(1) + s_3^+ \\ = \ln(3.0-F) - A - DQ. \end{aligned}$$

Substituting in the values for the parameters A through F and Q we obtain

$$\sum_{j=1}^2 \sum_{k=1}^4 [(0.11540)k + (0.020)P_j(1)]x_{jk}(1) + s_3^+ = 0.71886.$$

Since it was possible to satisfy the first and second goals if they were considered independently but not necessarily in combination with the other goals, they were assigned plus and minus slacks; thereby, allowing the goals to be either exceeded or not reached. It was known that it was not possible to satisfy the third goal so it was assigned a positive slack to measure the difference from the stated goal. The goal program for this sample situation can now be completely formulated as shown in Figure III.

The solution to our hypothetical problem was obtained using a computerized simplex linear program. The final basis contained the following vectors at the levels indicated:

$$x_{11}(1) = 0,$$

$$x_{12}(1) = 1,$$

$$x_{22}(1) = 0,$$

$$x_{23}(1) = 1,$$

$$s_2^- = 0.1914,$$

$$s_3^+ = 0.12756.$$

Since $x_{12}(1)$ and $x_{23}(1)$ are the only $x_{jk}(1)$ vectors in the final basis at a positive level, we know that the "best possible" solution is to use medium 1, Radio Frebia, twice ($x_{12}(1) = 1$) and medium 2, National Frebian, three times ($x_{23}(1) = 1$).

The fact that s_4 is not in the final basis indicates that we spent the entirety of our budgeted \$11,000 to obtain two units of medium 1 at \$1,000 per unit and three units of medium 2 at \$3,000 per unit.

$$\text{Minimize } z = s_1^+ + s_1^- + s_2^+ + s_2^- + s_3^+$$

Subject to

$$\sum_{j=1}^2 \sum_{k=1}^4 \ln[1-r_{jk}(1)]x_{jk}(1) + s_1^+ - s_1^- = \ln(1-.75)$$

$$\sum_{j=1}^2 \sum_{k=1}^4 d_{jk}(1)x_{jk}(1) + s_2^+ - s_2^- = 110,000$$

$$\sum_{j=1}^2 \sum_{k=1}^4 [(0.11540)k + (0.02P_j(1))]x_{jk}(1) + s_3^+ = 0.71886$$

$$\sum_{j=1}^2 \sum_{k=1}^4 c_{jk}(1)x_{jk}(1) + s_4 = 10,000$$

$$\sum_{k=1}^4 x_{1k}(1) + s_5 = 1$$

$$\sum_{k=1}^4 x_{2k}(1) + s_6 = 1$$

$$\sum_{k=1}^4 x_{1k}(1) + s_7 = 2$$

$$\sum_{k=1}^4 x_{2k}(1) + s_8 = 4$$

$$s_i, i=1,2,\dots,8; r_{jk}(1), d_{jk}(1), P_j(1), c_{jk}(1), x_{jk}(1) \geq 0 \forall j,k.$$

Figure III

Goal Program for Hypothetical Situation

The constraint for the gross target audience was also exactly satisfied since its slack, S_1 , is absent from the optimal basis. This may be easily verified by substituting in the values for $d_{jk}(1)$ in the stated goal; that is

$$d_{12}(1)x_{12}(1) + d_{23}(1)x_{23}(1) = 110,000$$

or

$$(38,000)(1) + (72,000)(1) = 110,000$$

since $x_{12}(1)$ and $x_{23}(1)$ are the only $x_{jk}(1)$ vectors greater than zero.

We did not quite reach the goal concerning the net target audience since the slack, S_2^- , associated with this goal is in the final basis at a positive level. We could verify this by computing the log values for the net target audience goal; however, it is more readily demonstrated using (3); i.e., by substituting the values for $r_{jk}(1)$ and $x_{jk}(1)$ in

$$1 - R(1) = \prod_{j=1}^2 \prod_{k=1}^4 (1 - r_{jk}(1))^{x_{jk}(1)}$$

we obtain

$$\begin{aligned} R(1) &= 1 - [1 - r_{12}(1)]^{x_{12}(1)} [1 - r_{23}(1)]^{x_{23}(1)}, \\ &= 1 - (1 - 0.43)^1 (1 - 0.638)^1, \\ &= 0.72566. \end{aligned}$$

Hence, 72.566 per cent of the total target audience will be subjected to propaganda at least once, thereby missing our stated goal of 75 per cent by approximately 2.5 per cent.

We knew that we would not satisfy the goal with respect to the distribution of frequencies. The difference between the goal, computed to be 0.71886, and the value of the slack

vector associated with this goal, $s_3^+ = 0.12756$, indicates that the combination of two broadcasts by Radio Frebia and three entries in the National Frebian will net a value for $\Phi^{-1}(1-H_3(1))$ of 0.59120. This implies that approximately 28 per cent of the net target audience will be subjected to propaganda at least three times by this mix of media.

The other vectors in the final basis, s_7 at a level of zero and s_8 at a level of 1, indicate that both broadcasts of Radio Frebia but only three of the four possible entries in National Frebian were used in the optimal basis to the goal program.

This simplified example demonstrated how this "goal programming" model could be applied in "real world" situations. The problems will be much more complex and the data gathering demanding; however, the results may well lead to more proficient psychological operations.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STUDY

Heretofore, proponents of a psychological operation usually relied on past experience and doctrinal methods in planning and implementing a campaign. The model presented in this paper is not a substitute for experience, nor is it meant to abrogate doctrine; but represents a tool that will allow examination of many alternative courses of action in a systematic and rapid manner. Experience and doctrinal factors may readily be used as a part of the model in the form of constraints. For instance, if experience has shown that at least one-fourth of an allotted budget should go into radio, this constraint could be added to the model. Likewise, "rigid" doctrine might require the insertion of at least one propaganda message in every national magazine, which could also be stated as constraints. In addition to these constraints, the procedures outlined herein allow us to establish goals for specific target audiences. (Recall that a target audience was that segment of the population that we particularly desire to "sell" a certain "product", where the "product" was the embodiment of a propaganda theme.) The goals discussed were with respect to the gross target audience, the net target audience, and the frequency distribution of the net target audience.

Use of the model should be predicated on a complete understanding of its limitations. In actuality, this formulation is a linear approximation to a problem that may not, in fact,

be linear. That is, the objective function and all constraints are stated as linear equations (inequalities); no second, third or higher degree terms are allowed. For this reason, such factors as the reinforcing effect that propaganda transmitted by one medium may have on that transmitted by another are not accounted for. However, linear approximations are not felt to be severe departures from reality.

It should be understood that these procedures are limited to use in predicting optimal allocation of media as a function of exposure to specified groupings. In using them we can specify which people we most desire to expose to propaganda. Further, we can establish the number of times we want to reach them. However, the model will not insure that the initial selection of primary and secondary target audiences is a good one; nor will it consider the impact of the propaganda on the target audience. In other words, it could possibly turn out that the most cost effective way of reaching a maximum number of people in a country is to fly a blimp (e.g., the Goodyear blimp) up and down the country for a couple of days with symbology or slogans painted on its side, signifying that the better life was on the way. A maximum number of people may be exposed to the message on the blimp but the number who actually registered the message or who were moved by the message may have been negligible. Hence, results must be carefully interpreted prior to implementing any major policy changes. Another major consideration that is not specifically accounted for here is the size of the newspaper article, length of radio broadcast, etc.; that is, if a medium

is listed as newspaper X, the model would consider the full page advertisement the same as a one line item at the bottom of the last column. This shortcoming can be overcome within the framework of the model by a judicious choice of media; e.g., a full page advertisement in newspaper X might be medium number ten, a half-page advertisement in newspaper X could be medium number eleven, etc.

The limitations that are specified in the above paragraphs are not meant to detract from the usefulness of the model, which can provide valuable insights into media allocation problems so long as results are interpreted with an understanding of the limitations of the model. Interviews with personnel in the advertising field have indicated that in initially using the model they were reaching solutions where the most cost-effective way to reach specified audiences was by total use of radio broadcasts. (The cost per number of people reached in each target audience was much less than for any other medium.) These results were not transformed into media plans for their clients because it was known that the impact of television and print advertising was much greater than that of radio. Hence, they then added constraints to the model as to the amount of money that could be allocated to radio and were then able to obtain useful results.

Recommendations for further research into modeling psychological operations are comparatively obvious. A means needs to be developed for classifying transmitted propaganda,

as to exposure and impact, as a function of media vehicle, length of transmission, content and type of audience. Procedures might also be developed for determining the effect of cumulative exposure and of establishing the point of diminishing (or even negative) returns for a particular propaganda theme. Ultimately, a method might be developed that would consider the entire spectrum of psychological operations. A major advertising agency has done work in considering overall advertising strategy and is presently using a model called DEMON (Decision Mapping Via Optimum Go-No Networks), which is a dynamic, adaptive model that uses extensions of chance programming to select optimal decision procedures.²⁹

It is hoped that the discussion, observations, and modeling techniques contained in this thesis will benefit future psychological operations. Although the problem of quantifying and dealing with the many variables inherent to psychological operations has by no means been completely solved, it is felt that a step has been taken in this direction.

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DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Naval Postgraduate School Monterey, California 93940		2a. REPORT SECURITY CLASSIFICATION Unclassified	
		2b. GROUP	
3. REPORT TITLE A MEDIA ALLOCATION MODEL FOR PSYCHOLOGICAL OPERATIONS			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Thesis			
5. AUTHOR(S) (Last name, first name, initial) LANIGAN, John Dennis, Major, USMC			
6. REPORT DATE June 1968		7a. TOTAL NO. OF PAGES 80	7b. NO. OF REFS 34
8a. CONTRACT OR GRANT NO. b. PROJECT NO. c. d.		9a. ORIGINATOR'S REPORT NUMBER(S) 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls and each transmission to foreign governments or foreign nationals may be made only with prior approval of the Naval Postgraduate School Monterey, California.			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY Naval Postgraduate School Monterey, California	
13. ABSTRACT <p>This thesis demonstrates the formulation and use of a "goal programming" model in optimizing the allocation of media for psychological operations. The parallels between advertising and psychological operations are outlined; particularly, those in connection with defining a product, specifying a target audience and measuring success. Attributes and limitations of the various forms of mass media are discussed. The problem is developed as one of minimizing the variance between a set of goals stated with respect to specified target audiences for varying time frames subject to budget and resource limitations. The goals considered are related to the total number of times that members of a target audience are subjected to propaganda, the percent subjected and frequency of subjection. Ultimately, a numerical example is presented to demonstrate the potential use of the model.</p>			

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
PSYCHOLOGICAL OPERATIONS						
PROPAGANDA						
PSYCHOLOGICAL WARFARE						
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